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204. Proposed by F. P. MATZ, Reading, Pa.

On a random chord in a circle two points are taken at random. What is the chance a second chord drawn at random will pass between the two points?

Solution by the late G. B. M. ZERR, Ph. D.

Let  $M, N$  be the two random points on the random chord  $AB$ ;  $O$ , the center of the circle;  $OA=OB=r$ ;  $AM=y$ ;  $MN=x$ ;  $\angle AOB=2\theta$ ;  $\mu$  the angle  $AB$  makes with some fixed line. Then  $AB=2r\sin\theta$ ; an element of the circle at  $M$  is  $r\sin\theta d\theta dy$ ; at  $N$ ,  $d\mu x dx$ .

The limits of  $\theta$  are 0 and  $\frac{1}{2}\pi$ ; of  $\mu$ , 0 and  $2\pi$ ; of  $y$ , 0 and  $2r\sin\theta$ ; of  $x$ , 0 and  $y$ . If the second random chord intersects the first, the chance that it passes between the points is  $x/2r\sin\theta$ . The chance that the second chord intersects the first is  $\frac{1}{3}$ . Therefore, if  $p$ =the chance, we get

$$p = \frac{\int_0^{\frac{1}{2}\pi} \int_0^{2\pi} \int_0^{2r\sin\theta} \int_0^y r x^2 \sin\theta d\theta d\mu dy dx}{\int_0^{\frac{1}{2}\pi} \int_0^{2\pi} \int_0^{2r\sin\theta} \int_0^y 2r^2 x \sin^2\theta d\theta d\mu dy dx} = \frac{1}{6}.$$

Also solved by J. E. Sanders, who obtains  $3/16$  as a result.

### MISCELLANEOUS.

177. Proposed by R. D. CARMICHAEL, Anniston, Ala.

Sum the infinite series:

$$\begin{aligned} \text{(a)} \quad & \sin x + nx \cos x - \frac{n^2 x^2}{2!} \sin x - \frac{n^3 x^3}{3!} \cos x + \frac{n^4 x^4}{4!} \sin x + \dots, \\ \text{(b)} \quad & \cos x - nx \sin x - \frac{n^2 x^2}{2!} \cos x + \frac{n^3 x^3}{3!} \sin x + \frac{n^4 x^4}{4!} \cos x \dots \end{aligned}$$

Solution by J. SCHEFFER, A. M., Kee Mar College, Hagerstown, Md., and G. B. M. ZERR, Ph. D.

(a) Arranging, we get

$$\sin x \left[ 1 - \frac{n^2 x^2}{2!} + \frac{n^4 x^4}{4!} \dots \right] + \cos x \left[ nx - \frac{n^3 x^3}{3!} + \frac{n^5 x^5}{5!} \dots \right]$$

$$= \sin x \cos nx + \cos x \sin nx = \sin(n+1)x.$$

$$\text{(b)} \quad \cos x \left[ 1 - \frac{n^2 x^2}{2!} + \frac{n^4 x^4}{4!} \dots \right] - \sin x \left[ nx - \frac{n^3 x^3}{3!} + \frac{n^5 x^5}{5!} \dots \right]$$

$$= \cos x \cos nx - \sin x \sin nx = \cos(n+1)x.$$

Also solved by Francis Rust and V. M. Spunar.